

1. A Lecture on the Red Corpuscle
of the Blood of Vertebrates, with
some Remarks on Man's place
in Nature.

2. A Lecture on Cells - Biographies
and Raphides in relation to
Systematic Botany.



(The two foregoing from the
11th Report of the East Kent
Natural History Society, Session
1868.)

3. Address on the Objects and
Management of Provincial
Museums. From the 14th Report
of the East Kent Natural History
Society, Session 1871.

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All the above by
J. R. S. Gulliver, F.R.S.

FIFTH MEETING.

Canterbury, June 9, 1868.

A meeting of this Society, was held on Tuesday, in the lecture-room of the Museum, Guildhall-street, Colonel Horsley in the chair. A very interesting lecture was delivered on the "Red Corpuseles of the Blood of Vertebrates," by George Gulliver, Esq., F.R.S., late Professor of Anatomy to the Collego of Surgeons and Surgeon in the Blues. The lecture was profusely illustrated by a magnificent set of coloured Diagrams, representing the corpuseles magnified 8000 diameters, and all drawn to one and the same scale, from the most remarkable examples of those corpuseles throughout the vertebrate sub-kingdom.

The PRESIDENT having introduced the lecturer in a few appropriate remarks,

Mr. GULLIVER rose and said,—No wonder that we should think of the blood in this county, where the illustrious discoverer of the circulation of that fluid was born; and in this city, where he received his scholastic education. His discovery was published in 1619, and he died in 1657.

But we are now to treat of a very important part of the blood which was unknown to Harvey. Marcellus Malpighi, an eminent Italian anatomist, whose name is steryotyped, as it were, into the records of zootomy and phytotomy, discovered the red corpuseles of the blood in 1673, sixteen years after Harvey's death, and William Molyneux first saw them circulating within their vessels in the



Water-newt in 1683, twenty-six years after the death of Harvey. And thus the circulation of the blood was first discovered by an Englishman who never saw that circulation, and first seen by another of our countrymen upwards of half a century after that discovery.

Independently of the leading fact of the circulation, Harvey's observations on the properties of the blood, and on the development of the vertebrate embryo, were so important and in advance of the knowledge of his time, as to be alone sufficient to vindicate the high character of British physiology at that period. But, as with other great men, his reputation rests almost entirely on his one greatest work, which thus eclipses his very valuable, but comparatively, smaller labours; just as his illustrious contemporary, Milton, is known rather by his wonderful epic than by those beautiful pieces which could only be called "minor" among his own works.

And now Harvey seems to be almost forgotten. We see little of his name even in the most comprehensive systems of animal physiology, either in this country or on the Continent. So apt are we to be ungrateful, forgetting the Creator in the Creation. And yet, besides his great discoveries, he was the first physiologist that gave a systematic demonstration of the truth of the declaration of the inspired writer of the Pentateuch—that "The Blood is the Life." Nothing at the time could be more exact and convincing, or even now more beautiful, than the series of observations and experiments by which Harvey finally established this great truth on a scientific basis. And now, like all immutable truth, once plainly displayed and proved, it is ours evermore.

The whole tenor of our observations on the corpuseles of the blood is a very remarkable accumulation of evidence in support of Harvey's doctrine. These corpuseles are truly living organisms, and have functions to perform of the very first importance in the vegetative or organic life of the animal; one and the same function in the same and each

class, as we might infer when we perceive how alike they are in form and structure in that class, as you see displayed in the diagrams before you. But, when we show the identity thus in Man and other Mammalia, let it not be supposed that we are only adding another fact to the number of late raked up to degrade the human species.

Indeed, it has recently become a common objection to anatomical pursuits, that they tend to lead to views calculated at once to outrage our common faith and our common sense. The objection is of so little weight that it can never permanently support itself, simply because such doctrines are not founded on the truth; that is to say, as our law wisely words it, "The whole truth, and nothing but the truth." It is a very old and sage proverb that "a lie stands on one leg, and the truth on two;" and every casuist well knows that more error is propagated in the shape of mere literal or half truths, than by point blank misstatements, as may be seen well illustrated in Fielding's prose epic, "Tom Jones," by Coleridge, in that excellent series of essays called the "Friend," and more recently by Tennyson in some lines specially on the subject. I said, as to the anatomical facts and doctrine, "raked up," because in the very same shape they were rife and vulgar about half a century since, having been imported into England, chiefly from the Continental Encyclopædists, and known here under the name of materialism; and this, because it attempted to reduce our judgment of man's nature, simply to a question of material structure—of mere brute anatomy—and thus to confine the evidence to nothing but a half truth. It seems amazing that sincere and conscientious philosophers—as I believe they are—should descend thus to reproduce a mass of stale, flat, and unprofitable facts and doctrine, as if they were fresh and new discoveries! And still more remarkable is it that those philosophers, in attempting thus to degrade mankind, should not perceive that they are only dealing with a half truth.

Even granting its literal accuracy in all respects—which

I do not—we must perceive that no correct judgment of such questions can be hoped for without a due consideration of the entire evidence, in the light of the full and comprehensive truth; and this includes the moral or psychological nature of man, as well as his mere structural or physical form. Thus considered in the light of the whole truth and nothing but the truth, we cannot avoid the conclusion that man is separated from the highest ape, as from all other brutes, by a gulf so utterly impassible, that any attempt to bridge it over by anatomical facts and speculations must ever be simply preposterous.

In short, without questioning the sincerity, or truthfulness so far as it goes, of those philosophers who confine their researches to this kind of materialism, we may certainly conclude, as to “Man’s position in Creation,” or “Man’s place in Nature,” that it is exactly where he has always found himself, and where his Maker put him, Lord of Creation—“with those thoughts that wander through eternity,”—at the head of all animated creatures, and elevated above the highest of them to an immeasurable extent. Nor shall we be led to any other opinion by the demonstration, now to be given, of the identity in structure between the red corpuscles of man and those of other mammalia.

And so we may go on our way, rejoicing that a right pursuit of anatomical science will certainly lead us to “look through nature up to nature’s God,” and as surely never afford the slightest proof that it is now, or ever was, any part of His design to develope an ape or any other beast into a man.

After a description of the three well-known chief proximate constituents of the blood, of which the red corpuscles form such a remarkable part, the lecturer remarked that it is usual in these inquiries to describe first the structure and then the function. But as the practical British mind ever meets one at the threshold with the question, “What’s the use of ’em,” we will mention this briefly now, and point

out the evidence in the sequel. The red corpuscles, then, vivify the blood, and through it the animal frame, and this mainly by the immediate agency of those corpuscles as carriers of oxygen, received from the atmosphere in their passage through the capillary vessels of the lungs, being, thus, most essential to the process of respiration and the production of animal heat; so that without these red corpuscles we should be instantly suffocated, and, in short, could neither move nor breathe nor have our being.

A comparative view of the size, form, and intimate structure of the red corpuscles throughout the vertebrate sub-kingdom was given by the aid of the illustrative diagrams. The smallest red corpuscles were discovered by the lecturer about twenty years since in the Musk-deer; and the largest among Mammalia in the great Anteater, the Capybara, and the Whale, excepting the Elephant, in which Mandl has previously discovered their like largeness. Of Birds, the smallest red corpuscles are found in the little Finches and Humming birds; the largest in such big species as the Ostrich. In scaly Reptiles the corpuscles are much smaller than in the naked batrachians or Amphibia, and in some of these last the largest red corpuscles yet known are found. In Fishes the largest corpuscles occur in the Sharks and Rays; the smallest in the osseous subdivision, in which a singular form, pointed at both ends, is presented in the corpuscles of the Pike. As a rule, in the oviparous vertebrates the corpuscles are more or less oval, flattened discs, and somewhat biconvex from slight projection of the nucleus; but in the Lamprey they are mostly circular; and many of this round shape, still discoid, occur among the majority of the oval discs in the blood of osseous fishes, as may be seen in *Gasterosteus*, *Mugil*, *Beloue*, &c. Indeed, all the oval corpuscles, whether of the camels or oviparous vertebrates, are apt to become rounded or globular from the action of incipient putrefaction and of pure water, and retain their oval shape in weak saline solutions. So, too, with the red corpuscle of mammalia, which is liable also to many variations

of shape from osmosis, irregular contractions or puckering, and granulation ; but the regular form of the red corpuscle in this class, including man, is a circular biconcave disc ; excepting the camels, all of which have oval discs, but these still in size and structure are quite mammalian. Some orders of mammalia, as the Ruminants, are characterized by the smallness of their red corpuscles ; and other orders, as the Edentates, by the comparative largeness of those discs.

The size of the red corpuscles is not a question merely of curiosity, by no means unimportant, as is too often supposed or ignorantly asserted, but is connected with the rest of the organization of the animal, especially with the perfection of the lungs and their function, in direct relation to which the largest proportion of surface is afforded by those corpuscles in subordination to their office as carriers of oxygen. This extension of their aggregate surface is provided by their relative abundance and small size ; by which minuteness the sum of the surface of a given quantity of them is vastly increased, just as the surface of an ounce of lead would be greater divided into small shot than into bullets. Given, therefore, the proportionate quantity of blood and of the amount and size of the red corpuscles of different species, the comparative degrees of heat in such species might, *ceteris paribus*, be inferred. Of the numerous proofs, by the researches of John Davy, Christison and others, that it is by the red corpuscles that the oxygen is carried to vivify the system, the most remarkable one is that of Brown—Sequard, almost like a miracle of the middle ages. Into the blood vessels of a dead and stark limb, on all parts of which the galvanic stimulus was quite powerless, he injected red corpuscles charged with oxygen, after which operation the muscles and fingers relaxed, so far by an actual revivification, and became obedient or sensible to galvanism.

As to structure, the Mammalian corpuscle consists mainly of a matter soluble in water, and of a thin membranous base which must by no means be confounded with a nu-

cleus. In oviparous vertebrates, on the contrary, besides the colouring and the membranous parts, the red corpuscle has a most distinct nucleus. And this very remarkable difference of structure is the most fundamental one between the Mammalia and oviparous vertebrates. Thus the lecturer distinguishes these two great sections as *Pyrenæmata* and *Apyrenæmata*, and declares that the shortest, most fundamental and universal single diagnostic character of Mammalia is *Vertebrates with non-nucleated red corpuscles of the blood.* There are two orders of facts in such inquiries, differing much in their value, judged by their significance, under the light of our still limited knowledge; the one set of facts minor, incidental, and isolated; the other large, constant, and central, and worth hundreds of the former as comprehending them all. Of these former, examples are such as occur in the curious deviations in the shape of the red corpuscles of the camels and certain fishes; of the latter facts, which appear with the dignity of central phenomena, that of the constant difference of structure between the *Pyrenæmatous* and *Apyrenæmatous* red corpuscles is an important exemplification. The whole of "this vexed question of a nucleus" affords a very curious and interesting chapter in physiological history; but the facts, often mistaken, denied, asserted, and confused, are now proved and placed at the service of systematic zoology.

And thus we have shown that the red corpuscles are so important, and so intimately related to the rest of the organization, as to form an essential and fundamental part of the anatomy of every species of the vertebrate sub-kingdom, never, consequently, to be disregarded in their description and classification, and these corpuscles affording, indeed, by their structure, at once the most certain and central difference between the two great divisions of that sub-kingdom. Whenever an aberration of the size of the red corpuscles occurs in a species—*e. g.* *Cercoleptes*, *Basaris*, *Hyrax*—that species will certainly prove an aberrant one in other parts of its organization; as shown too by their magnitude

or reptilian character in that paradoxical creature, the *Lepidosiren*, or Mud-fish, of Western Africa. No anatomist now, after examining simply the red corpuscles of the Whale and *Ornithorhynchus*, could for a moment think of degrading the one to a fish, or the other to a bird; nor, observing the great similarity of these corpuscles in birds, fail to perceive in this single fact an exponent of the remarkable uniformity of the general organization of this class.

In conclusion, we are led back to the grand declaration of our illustrious countryman, Harvey; that the blood is the primogenial part of the body, where the Lares and Penates of Life are enshrined—the immediate and chief seat of the vegetative faculties of the animal—the first part to live and the last to die of this our wondrous microcosm. I may add, too, as the child is more worthy than the cradle, so is the blood more worthy than the parts that merely contain or defend it, and that the Red Corpuscles have now been proved to occupy a most eminent place in the organic functions of the vertebrate animal.

And yet as to these researches we are often still pestered about “*cui bono?*” more “analogies” and “homologies?” wider “generalizations?” As if the uninquiring mind can expect to see the good of anything beyond its own knowledge; as if the study of difference, now so sadly neglected in anatomy, as Lord Bacon, too, complained was the case in his time, were not as important and more difficult than that of resemblance; and as if, of late years, in the present state of science, “knowing only in part,” we have not had some rather too sweeping generalizations—a sort of new Age of Reason:—

“No end, in wand’ring mazes lost:

* * * * *

Vain wisdom all, and false philosophy.”

